

**Pella Corporation**

102 Main Street  
Pella, Iowa 50219

PROJECT:  
***MULLION CALCULATIONS  
FOR VERTICAL AND HORIZONTAL MULLION***

SERIES: 3-9/16 x 1/2 Aluminum Structural Mullion  
Part Number (0A6G)

PROJECT NO.: 423-1101  
REPORT NO.: 0503-1  
DATE: 2/4/2024



Digitally signed  
by Robert J  
Amoruso  
Date:  
2024.02.06  
16:17:23 -05'00'

Prepared by:  
***PTC, PRODUCT DESIGN GROUP***  
P.O. Box 520775  
Longwood, Florida 32752  
Phone: (321) 690-1788  
Fax: (321-) 690-1789

ROBERT J. AMORUSO, P.E.  
FL. NO. 49752  
F.B.P.E. CERTIFICATE OF AUTHORIZATION NO. 25935



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 2 of 15

**SCOPE PTC, PRODUCT DESIGN GROUP** was contracted by Pella Corporation to perform engineering evaluations of various mulled window combinations. This report will be based on using the combined properties of the aluminum reinforcing mullion (#0A6G) and the weakest wood frame (Casement Window) as demonstrated in the section property portion of this report, based on an evaluation of possible groupings of mullions using section property comparisons in accordance with the AAMA 450-06/09/10. Structural analysis of the mullions is based on the current edition of the Florida Building Code – Building and Residential Volumes, Chapter 17 and Chapter 6 respectively using the product grouping method and tributary loading of AAMA 450.

**PRODUCT APPLICABILITY:** This report is applicable to the following Pella Corporation product lines and types only.

**1. Product Lines**

- a. Reserve Series, exterior clad and wood.
- b. Lifestyle Series with HGP, exterior clad
- c. Lifestyle Series without HGP, exterior clad
- d. Direct Set Aluminum Clad Wood Fixed Windows
- e. Pella Entry Systems, exterior clad and wood

**2. Product Types**

- a. Casement
- b. Awning
- c. Picture
- d. Direct Set Geometric and Radius
- e. Double Hung \*

\* Not applicable for vertical mulls on impact double hungs.

**3. Product Materials**

- a. Extruded aluminum for aluminum mullion and aluminum portions of window.
- b. Pine for wood portions of window.

The tributary areas are identified and calculated. These results are used to calculate the maximum pressure that the product can withstand without exceeding the allowable stresses or deflection. The minimum of these results is selected and defined as the design pressure for the product. Mullion stress and deflection is calculated using the AAMA 450 load distribution method.

For each mullion configuration, spreadsheet programs are used to calculate the apparent EI and equivalent I, a design pressure verification using equivalent I, and alternate spans from the design pressure calculation.



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 3 of 15

**ANALYSIS METHODOLOGY:**

The following methodology was used to develop the Load width span tables presented in this report.

1. Determine the allowable design pressure (D.P.) based on the actual shear stress, bending stress, deflection and mullion reactions as compared to their respect design allowables choosing the worst case.
- 2.. Worst case section properties determined by a comparison of the individual component sections of the applicable products, the cross sections exhibiting the lowest Moment of Inertia (I) and Section Modulus (Z) will be used. Area as it is related to shear stress does not govern design so it is not a deciding factor of the worst case section.
3. Using a ratio of the wood to aluminum Modulus of Elasticity (E) compute the overall apparent section properties of the worst case cross section.
4. Use the properties determined above in determining the load width/span tables.
5. Analysis based on:
  - a. Horizontal Shear Stress =  $P/A$  (psi)
  - b. Bending Stress =  $Mc/I = M/Z$  (psi)
    - i. M = bending moment and is equal to  $M/Kf$
    - ii.  $Kf$  is moment coefficient based on trapezoidal load distribution.
  - c. Deflection =  $wL^4 / KdEI = WL^3 / KdEI$ 
    - i.  $Kd$  is deflection coefficient based on trapezoidal distribution.
    - ii.  $W$  is load on mullion in Lbs. =  $wL$  where  $w$  is distributed load in Lbs/in and  $L$  in mullion span inches.
  - d. Mullion End Load Reactions
    - i. Based on trapezoidal load on mullion resolved into total load distributed to each end of mullion equally.
6. Load Width/Span Tables based on:
  - a. Solving for the allowable design pressure (D.P.) considering various window sizes and mullion spans.



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

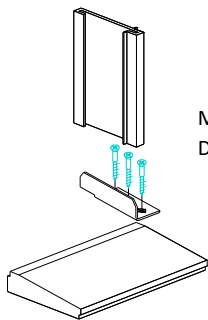
Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 4 of 15

**MULLION END ANCHORAGE:**

1. Calculated performance is based on the following:  
Mullions anchor plates
  - a. 512-B subsill anchor for slopped sill applications. (302 or 304 stainless steel)
  - b. 512-C clip mullion anchor type. (302 or 304 stainless steel)
  - c. 512-D fin mullion anchor type. (302 or 304 stainless steel)
  - d. OOOF H.I.G. plate (316 stainless steel)
  - e. 5071 installation type clip (A-653 Hot dipped Galvanized steel)

**MULLION ATTACHEMENT:**

2.
  - a. The reinforced aluminum mullion is secured **Directly** to the substrates using the above end anchorage .
  - b. **Mullion End Clip 512-B (Subsill anchor clip)**
    - i. The end clip is inserted into bottom end of mullion #0A6G by a "Pin-connection" (See detail A), below, and is used for sloped sill applications in combination with other mull clips used at top end of mullion.
    - ii. For clip attachment to wood frame substrates use three (3) #10 x 2" long or longer wood screws per clip leg into the installation bucking or frame with a minimum of 1 1/2" embedment into substrate and maintaining at least 3/4" minimum edge distance is required based on the analysis used in this report for development of the load width and span.
    - iii. For clip attachment to CMU or concrete frame substrates use two (2) 3/16" masonry type anchors per clip leg into the installation bucking or frame with a minimum of 1 1/4" embedment into substrate and maintaining at least 2 5/8" minimum edge distance is required based on the analysis used in this report for development of the load width and span.



Mullion End Clip 512-B (Subsill anchor clip)  
Detail A



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775

Longwood, Florida 32752

Client: Pella Corporation

Project #: 423-1101

Report #: 0503-1

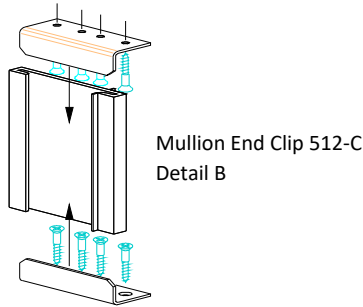
Prepared by: RJA

Date: 2/4/2024

Page 5 of 15

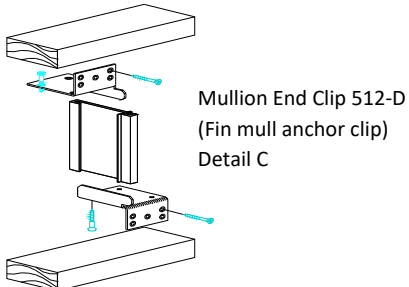
**c. Mullion End Clip 512-C**

- i. The end clip is inserted into each end of mullion #0A6G by a "Pin-connection" (See detail B), below.
- ii. For clip attachment to wood frame substrates use four (4) #10 x 2" long or longer wood screws per clip leg into the installation bucking or frame with a minimum of 1 1/2" embedment into substrate and maintaining at least 3/4" minimum edge distance is required based on the analysis used in this report for development of the load width and span.
- iii. For clip attachment to CMU or concrete frame substrates use two (2) 3/16" masonry type anchors per clip leg into the installation bucking or frame with a minimum of 1 1/4" embedment into substrate and maintaining at least 2 5/8" minimum edge distance is required based on the analysis used in this report for development of the load width and span.



**d. Mullion End Clip 512-D (Fin mull anchor clip)**

- i. The end clip is inserted into each end of mullion #0A6G by a "Pin-connection" (See detail C), below, and requires a minimum of 1-1/2" wood buck thickness and may be used in conjunction with mull clip 512-B Subsill anchor clip used at bottom of mullion end for sloped sill applications.
- ii. For clip attachment to wood frame substrates use five (5) #10 x 2" long or longer wood screws per clip leg into the installation bucking or frame with a minimum of 1 1/2" embedment into substrate and maintaining at least 3/4" minimum edge distance is required based on the analysis used in this report for development of the load width and span.





**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775

Longwood, Florida 32752

Client: Pella Corporation

Project #: 423-1101

Report #: 0503-1

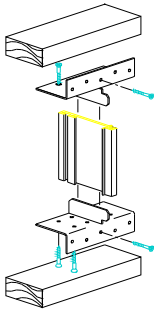
Prepared by: RJA

Date: 2/4/2024

Page 6 of 15

**e. Mullion End Clip #000F (Fin mull anchor clip)**

- i. The end clip is inserted into each end of mullion #0A6G by a "Pin-connection" (See detail D), below, and requires a minimum of 1-1/2" wood buck thickness.
- ii. For clip attachment to wood frame substrates use five (5) #10 x 2" long or longer wood screws per clip leg into the installation bucking or frame with a minimum of 1 1/2" embedment into substrate and maintaining at least 3/4" minimum edge distance is required based on the analysis used in this report for development of the load width and span.



Mullion End Clip 000F  
(Fin mull anchor clip)  
Detail D

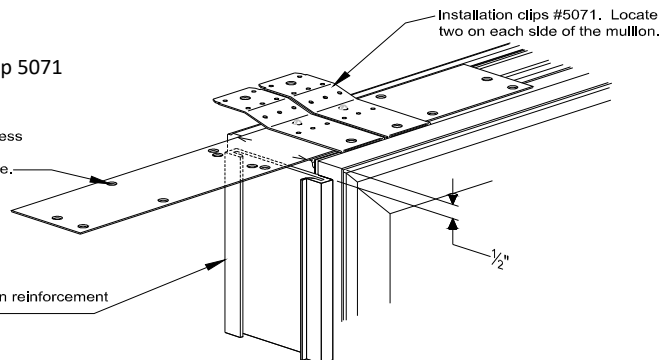
**f. Mullion End Clip 5071**

- i. The end clips are secured to each end of mullion #0A6G using a 20" steel plate #500P installed directly over mullion to secure both frames then install two (2) 5071 mull clips two at each side of the mullion, (See Detail E)
- ii. For 20" plate attachment to both window frames use ten (10) #8 x 5/8" stainless steel screws.
- iii. For clip attachment to wood frame substrates use a total of four (4) #10 x 2" long or longer wood screws on per each clip leg into the installation bucking or frame with a minimum of 1 1/2" embedment into substrate and maintaining at least 3/4" minimum edge distance, for clip attachment to window frames through plate use two (2) #5/8" stainless steel screws per each clip is required based on the analysis used in this report for development of the load width span.
- iv. For clip attachment to CMU or concrete substrates use a total of four (4) 3/16" dia. masonry anchors one (1) per each clip leg into the installation bucking or frame with a minimum of 1 1/4" embedment into substrate and maintaining at least 2 5/8" minimum edge distance each clip anchor hole spacing must be located at least on 2 1/4" spacing between anchors, for clip attachment to window frames through plate use two (2) #5/8" stainless steel screws per each individual clip is required based on the analysis of this report for development of the load width span.

Mullion End Clip 5071  
Detail E

Use ten #6 x 5/8" stainless steel wood screws to attach 20" plate to frame.

1/2" mullion reinforcement #0A6G





**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775

Longwood, Florida 32752

Client: Pella Corporation

Project #: 423-1101

Report #: 0503-1

Prepared by: RJA

Date: 2/4/2024

Page 7 of 15

REFERENCED DOCUMENTS:

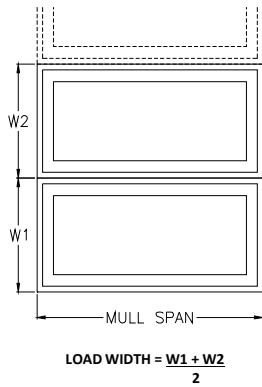
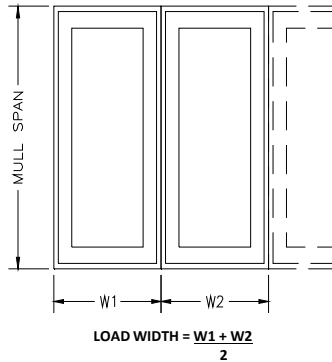
1. AAMA 450-06/09/10
2. Florida Building Code
  - a. Current Edition of the Florida Building Code (FBC), Building Volume
    - i. Chapter 17 - Mullions
  - b. Current Edition of the Florida Building Code (FBC), Residential volume
    - i. Chapter 6 - Mullions



PTC PRODUCT DESIGN GROUP, LLC

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 8 of 15



THIS CHART APPLIES TO MULTIPLE WIDE 1 HIGH, 1 WIDE MULTIPLE HIGH VERTICAL OR HORIZONTAL.

LOAD WIDTH MUST BE CALCULATED USING LARGEST ADJACENT (SIDE BY SIDE) WINDOW HEIGHTS OR WIDTHS.

MULL SPANS ARE RESTRICTED BY THE LONGEST SPAN, (ALL TABLES).

WINDOWS MAY BE INTERMIXED COMBINATIONS OF CASEMENT, AWNING, PICTURE, IN-SASH AND DIRECT SET GEOMETRIC OR RADIUS AND DOUBLE HUNG, (ALL TABLES).

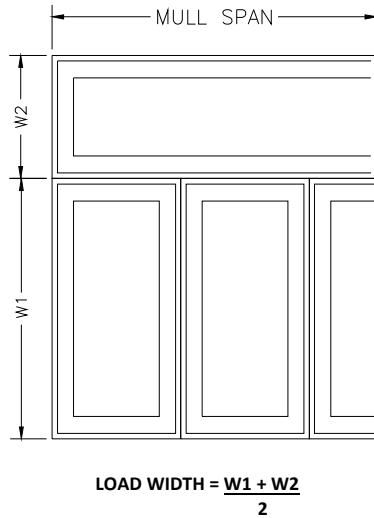
ALLOWABLE PRESSURES ON THE MULLED ASSEMBLY SHALL BE CONTROLLED BY THE LESSER OF MULLION OR THE INDIVIDUAL WINDOW UNIT.

\* For anchor clip attachment to substrates, see notes on sheets 4, 5 & 6 on this report.

| MULLION TABLE 1                                           |                  |                      |                             |                      |                      |                 |                  |                      |                             |                      |                      |                 |                  |                      |                             |                      |                      |
|-----------------------------------------------------------|------------------|----------------------|-----------------------------|----------------------|----------------------|-----------------|------------------|----------------------|-----------------------------|----------------------|----------------------|-----------------|------------------|----------------------|-----------------------------|----------------------|----------------------|
| (VERTICAL OR HORIZONTAL SPAN—MULLION REINFORCEMENT #0A6G) |                  |                      |                             |                      |                      |                 |                  |                      |                             |                      |                      |                 |                  |                      |                             |                      |                      |
| MULL SPAN (in.)                                           | LOAD WIDTH (in.) | CLIP TYPE 512B (PSF) | CLIP TYPE 512D, OOOOF (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) | MULL SPAN (in.) | LOAD WIDTH (in.) | CLIP TYPE 512B (PSF) | CLIP TYPE 512D, OOOOF (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) | MULL SPAN (in.) | LOAD WIDTH (in.) | CLIP TYPE 512B (PSF) | CLIP TYPE 512D, OOOOF (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) |
| 36                                                        | 24               | 85                   | 85                          | 85                   | 85                   | 66              | 24               | 70                   | 85                          | 85                   | 85                   | 96              | 24               | 45                   | 85                          | 56                   | 85                   |
|                                                           | 30               | 85                   | 85                          | 85                   | 85                   |                 | 30               | 59                   | 85                          | 74                   | 85                   |                 | 30               | 37                   | 81                          | 47                   | 81                   |
|                                                           | 36               | 85                   | 85                          | 85                   | 85                   |                 | 36               | 53                   | 85                          | 66                   | 85                   |                 | 36               | 32                   | 69                          | 40                   | 69                   |
|                                                           | 42               | 85                   | 85                          | 85                   | 85                   |                 | 42               | 48                   | 85                          | 60                   | 85                   |                 | 42               | 29                   | 60                          | 36                   | 60                   |
|                                                           | 48               | 85                   | 85                          | 85                   | 85                   |                 | 48               | 45                   | 85                          | 56                   | 85                   |                 | 48               | 26                   | 54                          | 33                   | 54                   |
|                                                           | 54               | 85                   | 85                          | 85                   | 85                   |                 | 54               | 43                   | 85                          | 54                   | 85                   |                 | 54               | 24                   | 49                          | 30                   | 49                   |
|                                                           | 60               | 85                   | 85                          | 85                   | 85                   |                 | 60               | 42                   | 85                          | 53                   | 85                   |                 | 60               | 23                   | 46                          | 29                   | 46                   |
|                                                           | 66               | 85                   | 85                          | 85                   | 85                   |                 | 66               | 42                   | 85                          | 52                   | 85                   |                 | 66               | 22                   | 43                          | 27                   | 43                   |
| 42                                                        | 24               | 85                   | 85                          | 85                   | 85                   | 72              | 24               | 63                   | 85                          | 79                   | 85                   | 102             | 24               | 42                   | 83                          | 53                   | 83                   |
|                                                           | 30               | 85                   | 85                          | 85                   | 85                   |                 | 30               | 53                   | 85                          | 66                   | 85                   |                 | 30               | 35                   | 67                          | 43                   | 67                   |
|                                                           | 36               | 85                   | 85                          | 85                   | 85                   |                 | 36               | 47                   | 85                          | 58                   | 85                   |                 | 36               | 30                   | 57                          | 38                   | 57                   |
|                                                           | 42               | 85                   | 85                          | 85                   | 85                   |                 | 42               | 42                   | 85                          | 53                   | 85                   |                 | 42               | 27                   | 50                          | 33                   | 50                   |
|                                                           | 48               | 85                   | 85                          | 85                   | 85                   |                 | 48               | 39                   | 85                          | 49                   | 85                   |                 | 48               | 24                   | 44                          | 30                   | 44                   |
|                                                           | 54               | 85                   | 85                          | 85                   | 85                   |                 | 54               | 37                   | 85                          | 47                   | 85                   |                 | 54               | 22                   | 41                          | 28                   | 41                   |
|                                                           | 60               | 85                   | 85                          | 85                   | 85                   |                 | 60               | 36                   | 85                          | 45                   | 85                   |                 | 60               | 21                   | 37                          | 26                   | 37                   |
|                                                           | 66               | 85                   | 85                          | 85                   | 85                   |                 | 66               | 35                   | 85                          | 44                   | 85                   |                 | 66               | 20                   | 35                          | 25                   | 35                   |
| 48                                                        | 24               | 85                   | 85                          | 85                   | 85                   | 78              | 24               | 57                   | 85                          | 72                   | 85                   | 108             | 24               | 39                   | 70                          | 49                   | 70                   |
|                                                           | 30               | 85                   | 85                          | 85                   | 85                   |                 | 30               | 48                   | 85                          | 60                   | 85                   |                 | 30               | 33                   | 56                          | 41                   | 56                   |
|                                                           | 36               | 84                   | 85                          | 85                   | 85                   |                 | 36               | 42                   | 85                          | 53                   | 85                   |                 | 36               | 28                   | 48                          | 35                   | 48                   |
|                                                           | 42               | 80                   | 85                          | 85                   | 85                   |                 | 42               | 38                   | 85                          | 47                   | 85                   |                 | 42               | 25                   | 42                          | 31                   | 42                   |
|                                                           | 48               | 79                   | 85                          | 85                   | 85                   |                 | 48               | 35                   | 84                          | 44                   | 85                   |                 | 48               | 23                   | 37                          | 28                   | 37                   |
|                                                           | 54               | 79                   | 85                          | 85                   | 85                   |                 | 54               | 33                   | 79                          | 41                   | 82                   |                 | 54               | 21                   | 34                          | 26                   | 34                   |
|                                                           | 60               | 79                   | 85                          | 85                   | 85                   |                 | 60               | 32                   | 76                          | 39                   | 79                   |                 | 60               | 19                   | 31                          | 24                   | 31                   |
|                                                           | 66               | 79                   | 85                          | 85                   | 85                   |                 | 66               | 31                   | 74                          | 38                   | 76                   |                 | 66               | 18                   | 29                          | 23                   | 29                   |
| 54                                                        | 24               | 85                   | 85                          | 85                   | 85                   | 84              | 24               | 53                   | 85                          | 66                   | 85                   |                 |                  |                      |                             |                      |                      |
|                                                           | 30               | 78                   | 85                          | 85                   | 85                   |                 | 30               | 44                   | 85                          | 55                   | 85                   |                 |                  |                      |                             |                      |                      |
|                                                           | 36               | 70                   | 85                          | 85                   | 85                   |                 | 36               | 38                   | 85                          | 48                   | 85                   |                 |                  |                      |                             |                      |                      |
|                                                           | 42               | 65                   | 85                          | 82                   | 85                   |                 | 42               | 34                   | 83                          | 43                   | 85                   |                 |                  |                      |                             |                      |                      |
|                                                           | 48               | 63                   | 85                          | 79                   | 85                   |                 | 48               | 32                   | 76                          | 39                   | 79                   |                 |                  |                      |                             |                      |                      |
|                                                           | 54               | 62                   | 85                          | 78                   | 85                   |                 | 54               | 29                   | 71                          | 37                   | 74                   |                 |                  |                      |                             |                      |                      |
|                                                           | 60               | 62                   | 85                          | 78                   | 85                   |                 | 60               | 28                   | 68                          | 35                   | 70                   |                 |                  |                      |                             |                      |                      |
|                                                           | 66               | 62                   | 85                          | 78                   | 85                   |                 | 66               | 27                   | 65                          | 34                   | 67                   |                 |                  |                      |                             |                      |                      |
| 60                                                        | 24               | 79                   | 85                          | 85                   | 85                   | 90              | 24               | 48                   | 85                          | 61                   | 85                   |                 |                  |                      |                             |                      |                      |
|                                                           | 30               | 67                   | 85                          | 84                   | 85                   |                 | 30               | 40                   | 85                          | 50                   | 85                   |                 |                  |                      |                             |                      |                      |
|                                                           | 36               | 60                   | 85                          | 75                   | 85                   |                 | 36               | 35                   | 84                          | 44                   | 84                   |                 |                  |                      |                             |                      |                      |
|                                                           | 42               | 55                   | 85                          | 69                   | 85                   |                 | 42               | 31                   | 74                          | 39                   | 74                   |                 |                  |                      |                             |                      |                      |
|                                                           | 48               | 53                   | 85                          | 66                   | 85                   |                 | 48               | 29                   | 66                          | 36                   | 66                   |                 |                  |                      |                             |                      |                      |
|                                                           | 54               | 51                   | 85                          | 64                   | 85                   |                 | 54               | 27                   | 61                          | 33                   | 61                   |                 |                  |                      |                             |                      |                      |
|                                                           | 60               | 50                   | 85                          | 63                   | 85                   |                 | 60               | 25                   | 57                          | 32                   | 57                   |                 |                  |                      |                             |                      |                      |
|                                                           | 66               | 50                   | 85                          | 63                   | 85                   |                 | 66               | 24                   | 54                          | 30                   | 54                   |                 |                  |                      |                             |                      |                      |

\* Use this table for intermediate 2-way mullions.

\* Clip type 512-B used for vertical mullion end attachment only.



THIS CHART APPLIES TO ("T") 3-WAY MULLS.

LOAD WIDTH MUST BE CALCULATED USING LARGEST ADJACENT (SIDE BY SIDE) WINDOW HEIGHTS OR WIDTHS.

MULL SPANS ARE RESTRICTED BY THE LONGEST SPAN, (ALL TABLES).

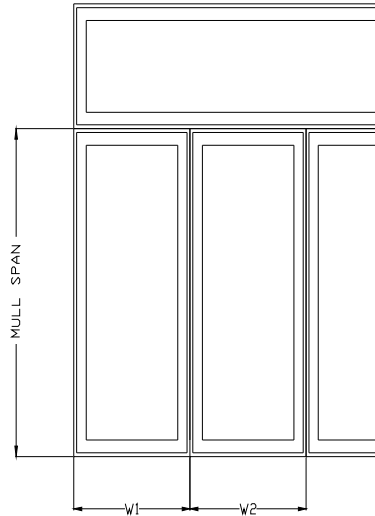
WINDOWS MAY BE INTERMIXED COMBINATIONS OF CASEMENT, AWNING, PICTURE, IN-SASH AND DIRECT SET GEOMETRIC OR RADIUS AND DOUBLE HUNG, (ALL TABLES).

ALLOWABLE PRESSURES ON THE MULLED ASSEMBLY SHALL BE CONTROLLED BY THE LESSER OF MULLION OR THE INDIVIDULE WINDOW UNIT.

\* For anchor clip attachment to substrates, see notes on sheets 4, 5 & 6 on this report.

\*Table 2A is to be used for the horizontal mullion that goes through the 3-way frame intersection, which is the structural through-mull, use table 1 for the remaining, intermediate 2-way mullions.

| MULLION TABLE 2A<br>(HORIZONTAL SPAN—MULLION REINFORCEMENT #0A6G) |                  |                           |                      |                      |                 |                  |                           |                      |                      |
|-------------------------------------------------------------------|------------------|---------------------------|----------------------|----------------------|-----------------|------------------|---------------------------|----------------------|----------------------|
| MULL SPAN (in.)                                                   | LOAD WIDTH (in.) | CLIP TYPE 512D, OOF (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) | MULL SPAN (in.) | LOAD WIDTH (in.) | CLIP TYPE 512D, OOF (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) |
| 30                                                                | 30               | 85                        | 85                   | 85                   | 66              | 30               | 85                        | 75                   | 85                   |
|                                                                   | 36               | 85                        | 85                   | 85                   |                 | 36               | 85                        | 66                   | 85                   |
|                                                                   | 42               | 85                        | 85                   | 85                   |                 | 42               | 85                        | 59                   | 85                   |
|                                                                   | 48               | 85                        | 85                   | 85                   |                 | 48               | 85                        | 54                   | 85                   |
|                                                                   | 54               | 85                        | 85                   | 85                   |                 | 54               | 85                        | 50                   | 85                   |
|                                                                   | 60               | 85                        | 85                   | 85                   |                 | 60               | 85                        | 47                   | 85                   |
|                                                                   | 66               | 85                        | 85                   | 85                   |                 | 66               | 85                        | 45                   | 85                   |
| 36                                                                | 72               | 85                        | 85                   | 85                   | 72              | 72               | 83                        | 43                   | 85                   |
|                                                                   | 30               | 85                        | 85                   | 85                   |                 | 30               | 85                        | 67                   | 85                   |
|                                                                   | 36               | 85                        | 85                   | 85                   |                 | 36               | 85                        | 59                   | 85                   |
|                                                                   | 42               | 85                        | 85                   | 85                   |                 | 42               | 85                        | 53                   | 85                   |
|                                                                   | 48               | 85                        | 85                   | 85                   |                 | 48               | 85                        | 48                   | 85                   |
|                                                                   | 54               | 85                        | 85                   | 85                   |                 | 54               | 85                        | 44                   | 85                   |
|                                                                   | 60               | 85                        | 85                   | 85                   |                 | 60               | 80                        | 42                   | 83                   |
| 42                                                                | 66               | 85                        | 85                   | 85                   | 78              | 66               | 76                        | 39                   | 79                   |
|                                                                   | 72               | 85                        | 85                   | 85                   |                 | 72               | 73                        | 38                   | 75                   |
|                                                                   | 30               | 85                        | 85                   | 85                   |                 | 30               | 85                        | 49                   | 85                   |
|                                                                   | 36               | 85                        | 85                   | 85                   |                 | 36               | 85                        | 53                   | 85                   |
|                                                                   | 42               | 85                        | 85                   | 85                   |                 | 42               | 85                        | 47                   | 85                   |
|                                                                   | 48               | 85                        | 85                   | 85                   |                 | 48               | 83                        | 43                   | 85                   |
|                                                                   | 54               | 85                        | 85                   | 85                   |                 | 54               | 77                        | 40                   | 80                   |
| 48                                                                | 60               | 85                        | 85                   | 85                   | 84              | 60               | 72                        | 37                   | 75                   |
|                                                                   | 66               | 85                        | 85                   | 85                   |                 | 66               | 68                        | 35                   | 70                   |
|                                                                   | 72               | 85                        | 85                   | 85                   |                 | 72               | 65                        | 34                   | 67                   |
|                                                                   | 30               | 85                        | 85                   | 85                   |                 | 30               | 83                        | 43                   | 85                   |
|                                                                   | 36               | 85                        | 85                   | 85                   |                 | 36               | 85                        | 48                   | 85                   |
|                                                                   | 42               | 85                        | 85                   | 85                   |                 | 42               | 83                        | 43                   | 85                   |
|                                                                   | 48               | 85                        | 83                   | 85                   |                 | 48               | 76                        | 39                   | 78                   |
| 54                                                                | 54               | 85                        | 79                   | 85                   | 90              | 54               | 70                        | 36                   | 72                   |
|                                                                   | 60               | 85                        | 75                   | 85                   |                 | 60               | 65                        | 34                   | 67                   |
|                                                                   | 66               | 85                        | 73                   | 85                   |                 | 66               | 61                        | 32                   | 64                   |
|                                                                   | 72               | 85                        | 72                   | 85                   |                 | 72               | 58                        | 30                   | 60                   |
|                                                                   | 30               | 85                        | 85                   | 85                   |                 | 30               | 74                        | 38                   | 77                   |
|                                                                   | 36               | 85                        | 85                   | 85                   |                 | 36               | 69                        | 36                   | 72                   |
|                                                                   | 42               | 85                        | 77                   | 85                   |                 | 42               | 76                        | 39                   | 77                   |
| 60                                                                | 48               | 85                        | 71                   | 85                   | 96              | 48               | 69                        | 36                   | 69                   |
|                                                                   | 54               | 85                        | 66                   | 85                   |                 | 54               | 63                        | 33                   | 63                   |
|                                                                   | 60               | 85                        | 63                   | 85                   |                 | 60               | 58                        | 31                   | 58                   |
|                                                                   | 66               | 85                        | 61                   | 85                   |                 | 66               | 54                        | 29                   | 54                   |
|                                                                   | 72               | 85                        | 59                   | 85                   |                 | 72               | 51                        | 27                   | 51                   |
|                                                                   | 30               | 85                        | 85                   | 85                   |                 | 30               | 66                        | 34                   | 69                   |
|                                                                   | 36               | 85                        | 74                   | 85                   |                 | 36               | 62                        | 32                   | 64                   |
|                                                                   | 42               | 85                        | 67                   | 85                   |                 | 42               | 62                        | 36                   | 62                   |
|                                                                   | 48               | 85                        | 61                   | 85                   |                 | 48               | 56                        | 33                   | 56                   |
|                                                                   | 54               | 85                        | 57                   | 85                   |                 | 54               | 51                        | 30                   | 51                   |
|                                                                   | 60               | 85                        | 54                   | 85                   |                 | 60               | 47                        | 28                   | 47                   |
|                                                                   | 66               | 85                        | 51                   | 85                   |                 | 66               | 44                        | 26                   | 44                   |
|                                                                   | 72               | 85                        | 50                   | 85                   |                 | 72               | 41                        | 25                   | 41                   |



$$\text{LOAD WIDTH} = \text{W1} + \text{W2}$$

THIS CHART APPLIES TO ("T") 3-WAY MULLS.

LOAD WIDTH MUST BE CALCULATED USING LARGEST ADJACENT (SIDE BY SIDE) WINDOW HEIGHTS OR WIDTHS.

MULL SPANS ARE RESTRICTED BY THE LONGEST SPAN, (ALL TABLES).

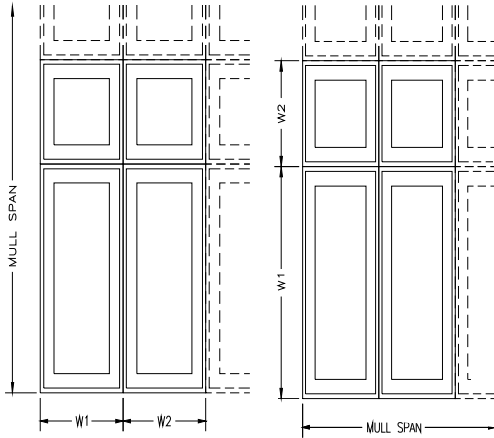
WINDOWS MAY BE INTERMIXED COMBINATIONS OF CASEMENT, AWNING, PICTURE, IN-SASH AND DIRECT SET GEOMETRIC OR RADIUS AND DOUBLE HUNG, (ALL TABLES).

ALLOWABLE PRESSURES ON THE MULLED ASSEMBLY SHALL BE CONTROLLED BY THE LESSER OF MULLION OR THE INDIVIDULE WINDOW UNIT.

\* For anchor clip attachment to substrates, see notes on sheets 4, 5 & 6 on this report.

\*Table 2B is to be used for the mullion that frames into the 3-way frame intersection, at the horizontal which is the structural through mull.

| MULLION TABLE 2B<br>(VERTICAL SPAN—MULLION REINFORCEMENT #0A6G) |                  |                      |                           |                      |                      |                 |                  |                      |                           |                      |                      |
|-----------------------------------------------------------------|------------------|----------------------|---------------------------|----------------------|----------------------|-----------------|------------------|----------------------|---------------------------|----------------------|----------------------|
| MULL SPAN (in.)                                                 | LOAD WIDTH (in.) | CLIP TYPE 512B (PSF) | CLIP TYPE 512D, OOO (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) | MULL SPAN (in.) | LOAD WIDTH (in.) | CLIP TYPE 512B (PSF) | CLIP TYPE 512D, OOO (PSF) | CLIP TYPE 512C (PSF) | CLIP TYPE 5071 (PSF) |
| 36                                                              | 15               | 85                   | 85                        | 85                   | 85                   | 60              | 15               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 18               | 85                   | 85                        | 85                   | 85                   |                 | 18               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 21               | 85                   | 85                        | 85                   | 85                   |                 | 21               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 24               | 85                   | 85                        | 85                   | 85                   |                 | 24               | 79                   | 85                        | 85                   | 85                   |
|                                                                 | 27               | 85                   | 85                        | 85                   | 85                   |                 | 27               | 72                   | 85                        | 85                   | 85                   |
|                                                                 | 30               | 85                   | 85                        | 85                   | 85                   |                 | 30               | 67                   | 85                        | 84                   | 85                   |
|                                                                 | 33               | 85                   | 85                        | 85                   | 85                   |                 | 33               | 63                   | 85                        | 79                   | 85                   |
|                                                                 | 36               | 85                   | 85                        | 85                   | 85                   |                 | 36               | 60                   | 85                        | 75                   | 85                   |
|                                                                 | 39               | 85                   | 85                        | 85                   | 85                   |                 | 39               | 57                   | 85                        | 72                   | 85                   |
|                                                                 | 42               | 85                   | 85                        | 85                   | 85                   |                 | 42               | 55                   | 85                        | 69                   | 85                   |
|                                                                 | 45               | 85                   | 85                        | 85                   | 85                   |                 | 45               | 54                   | 85                        | 67                   | 85                   |
|                                                                 | 48               | 85                   | 85                        | 85                   | 85                   |                 | 48               | 53                   | 85                        | 66                   | 85                   |
| 42                                                              | 15               | 85                   | 85                        | 85                   | 85                   | 66              | 15               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 18               | 85                   | 85                        | 85                   | 85                   |                 | 18               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 21               | 85                   | 85                        | 85                   | 85                   |                 | 21               | 78                   | 85                        | 85                   | 85                   |
|                                                                 | 24               | 85                   | 85                        | 85                   | 85                   |                 | 24               | 70                   | 85                        | 85                   | 85                   |
|                                                                 | 27               | 85                   | 85                        | 85                   | 85                   |                 | 27               | 64                   | 85                        | 80                   | 85                   |
|                                                                 | 30               | 85                   | 85                        | 85                   | 85                   |                 | 30               | 59                   | 85                        | 74                   | 85                   |
|                                                                 | 33               | 85                   | 85                        | 85                   | 85                   |                 | 33               | 56                   | 85                        | 69                   | 85                   |
|                                                                 | 36               | 85                   | 85                        | 85                   | 85                   |                 | 36               | 53                   | 85                        | 66                   | 85                   |
|                                                                 | 39               | 85                   | 85                        | 85                   | 85                   |                 | 39               | 50                   | 85                        | 63                   | 85                   |
|                                                                 | 42               | 85                   | 85                        | 85                   | 85                   |                 | 42               | 48                   | 85                        | 60                   | 85                   |
|                                                                 | 45               | 85                   | 85                        | 85                   | 85                   |                 | 45               | 46                   | 85                        | 58                   | 85                   |
|                                                                 | 48               | 85                   | 85                        | 85                   | 85                   |                 | 48               | 45                   | 85                        | 56                   | 85                   |
| 48                                                              | 15               | 85                   | 85                        | 85                   | 85                   | 72              | 15               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 18               | 85                   | 85                        | 85                   | 85                   |                 | 18               | 80                   | 85                        | 85                   | 85                   |
|                                                                 | 21               | 85                   | 85                        | 85                   | 85                   |                 | 21               | 70                   | 85                        | 85                   | 85                   |
|                                                                 | 24               | 85                   | 85                        | 85                   | 85                   |                 | 24               | 63                   | 85                        | 79                   | 85                   |
|                                                                 | 27               | 85                   | 85                        | 85                   | 85                   |                 | 27               | 57                   | 85                        | 72                   | 85                   |
|                                                                 | 30               | 85                   | 85                        | 85                   | 85                   |                 | 30               | 53                   | 85                        | 66                   | 85                   |
|                                                                 | 33               | 85                   | 85                        | 85                   | 85                   |                 | 33               | 50                   | 85                        | 62                   | 85                   |
|                                                                 | 36               | 84                   | 85                        | 85                   | 85                   |                 | 36               | 47                   | 85                        | 58                   | 85                   |
|                                                                 | 39               | 82                   | 85                        | 85                   | 85                   |                 | 39               | 44                   | 85                        | 55                   | 85                   |
|                                                                 | 42               | 80                   | 85                        | 85                   | 85                   |                 | 42               | 42                   | 85                        | 53                   | 85                   |
|                                                                 | 45               | 79                   | 85                        | 85                   | 85                   |                 | 45               | 41                   | 85                        | 51                   | 85                   |
|                                                                 | 48               | 79                   | 85                        | 85                   | 85                   |                 | 48               | 39                   | 85                        | 49                   | 85                   |
| 54                                                              | 15               | 85                   | 85                        | 85                   | 85                   | 78              | 15               | 85                   | 85                        | 85                   | 85                   |
|                                                                 | 18               | 85                   | 85                        | 85                   | 85                   |                 | 18               | 73                   | 85                        | 85                   | 85                   |
|                                                                 | 21               | 85                   | 85                        | 85                   | 85                   |                 | 21               | 64                   | 85                        | 80                   | 85                   |
|                                                                 | 24               | 85                   | 85                        | 85                   | 85                   |                 | 24               | 57                   | 85                        | 72                   | 85                   |
|                                                                 | 27               | 83                   | 85                        | 85                   | 85                   |                 | 27               | 52                   | 85                        | 65                   | 85                   |
|                                                                 | 30               | 78                   | 85                        | 85                   | 85                   |                 | 30               | 48                   | 85                        | 60                   | 85                   |
|                                                                 | 33               | 73                   | 85                        | 85                   | 85                   |                 | 33               | 45                   | 85                        | 56                   | 85                   |
|                                                                 | 36               | 70                   | 85                        | 85                   | 85                   |                 | 36               | 42                   | 85                        | 53                   | 85                   |
|                                                                 | 39               | 67                   | 85                        | 84                   | 85                   |                 | 39               | 40                   | 85                        | 50                   | 85                   |
|                                                                 | 42               | 65                   | 85                        | 82                   | 85                   |                 | 42               | 38                   | 85                        | 47                   | 85                   |
|                                                                 | 45               | 64                   | 85                        | 80                   | 85                   |                 | 45               | 36                   | 85                        | 45                   | 85                   |
|                                                                 | 48               | 63                   | 85                        | 79                   | 85                   |                 | 48               | 35                   | 84                        | 44                   | 85                   |



$$\text{LOAD WIDTH} = W1 + W2$$

THIS CHART APPLIES TO 4-WAY INTERSECTING HORIZONTAL OR WHERE THE VERTICAL MULLION RUNS THROUGH FULL LENGTH.

LOAD WIDTH MUST BE CALCULATED USING LARGEST ADJACENT (SIDE BY SIDE) WINDOW HEIGHTS OR WIDTHS.

MULL SPANS ARE RESTRICTED BY THE LONGEST SPAN, (ALL TABLES).

WINDOWS MAY BE INTERMIXED COMBINATIONS OF CASEMENT, AWNING, PICTURE, IN-SASH AND DIRECT SET GEOMETRIC OR RADIUS AND DOUBLE HUNG, (ALL TABLES).

ALLOWABLE PRESSURES ON THE MULLED ASSEMBLY SHALL BE CONTROLLED BY THE LESSER OF MULLION OR THE INDIVIDUAL WINDOW UNIT.

\* For anchor clip attachment to substrates, see sheets 4, 5 & 6 on this report.

\* Clip type 512-B used for vertical mullion end attachment only.

| MULLION TABLE 3<br>(VERTICAL OR HORIZONTAL 4-WAY SPAN—MULLION REINFORCEMENT #0A6G) |                        |                               |                                        |                               |                               |                       |                         |                               |                                        |                               |                               |                       |                        |                               |                                        |                               |                               |
|------------------------------------------------------------------------------------|------------------------|-------------------------------|----------------------------------------|-------------------------------|-------------------------------|-----------------------|-------------------------|-------------------------------|----------------------------------------|-------------------------------|-------------------------------|-----------------------|------------------------|-------------------------------|----------------------------------------|-------------------------------|-------------------------------|
| MULL SPAN<br>SPAN<br>(in.)                                                         | LOAD<br>WIDTH<br>(in.) | CLIP<br>TYPE<br>512B<br>(PSF) | CLIP<br>TYPE<br>512D,<br>OOOF<br>(PSF) | CLIP<br>TYPE<br>512C<br>(PSF) | CLIP<br>TYPE<br>5071<br>(PSF) | MULL<br>SPAN<br>(in.) | LOAD<br>WIDT<br>H (in.) | CLIP<br>TYPE<br>512B<br>(PSF) | CLIP<br>TYPE<br>512D,<br>OOOF<br>(PSF) | CLIP<br>TYPE<br>512C<br>(PSF) | CLIP<br>TYPE<br>5071<br>(PSF) | MULL<br>SPAN<br>(in.) | LOAD<br>WIDTH<br>(in.) | CLIP<br>TYPE<br>512B<br>(PSF) | CLIP<br>TYPE<br>512D,<br>OOOF<br>(PSF) | CLIP<br>TYPE<br>512C<br>(PSF) | CLIP<br>TYPE<br>5071<br>(PSF) |
| 36                                                                                 | 24                     | 85                            | 85                                     | 85                            | 85                            | 66                    | 24                      | 85                            | 85                                     | 65                            | 85                            | 96                    | 24                     | 56                            | 46                                     | 34                            | 46                            |
|                                                                                    | 30                     | 85                            | 85                                     | 85                            | 85                            |                       | 30                      | 74                            | 85                                     | 61                            | 85                            |                       | 30                     | 47                            | 38                                     | 32                            | 38                            |
|                                                                                    | 36                     | 85                            | 85                                     | 85                            | 85                            |                       | 36                      | 66                            | 85                                     | 66                            | 85                            |                       | 36                     | 40                            | 33                                     | 31                            | 33                            |
|                                                                                    | 42                     | 85                            | 85                                     | 85                            | 85                            |                       | 42                      | 60                            | 85                                     | 59                            | 85                            |                       | 42                     | 36                            | 30                                     | 29                            | 30                            |
|                                                                                    | 48                     | 85                            | 85                                     | 85                            | 85                            |                       | 48                      | 56                            | 85                                     | 55                            | 85                            |                       | 48                     | 33                            | 27                                     | 27                            | 27                            |
|                                                                                    | 54                     | 85                            | 85                                     | 85                            | 85                            |                       | 54                      | 54                            | 77                                     | 51                            | 77                            |                       | 54                     | 30                            | 29                                     | 29                            | 29                            |
|                                                                                    | 60                     | 85                            | 85                                     | 85                            | 85                            |                       | 60                      | 53                            | 66                                     | 48                            | 66                            |                       | 60                     | 29                            | 25                                     | 25                            | 25                            |
|                                                                                    | 66                     | 85                            | 85                                     | 85                            | 85                            |                       | 66                      | 52                            | 57                                     | 46                            | 57                            |                       | 66                     | 27                            | 22                                     | 22                            | 22                            |
| 42                                                                                 | 24                     | 85                            | 85                                     | 85                            | 85                            | 72                    | 24                      | 79                            | 85                                     | 56                            | 85                            | 102                   | 24                     | 53                            | 38                                     | 31                            | 38                            |
|                                                                                    | 30                     | 85                            | 85                                     | 85                            | 85                            |                       | 30                      | 66                            | 85                                     | 53                            | 85                            |                       | 30                     | 43                            | 32                                     | 29                            | 32                            |
|                                                                                    | 36                     | 85                            | 85                                     | 85                            | 85                            |                       | 36                      | 58                            | 85                                     | 58                            | 85                            |                       | 36                     | 38                            | 27                                     | 27                            | 27                            |
|                                                                                    | 42                     | 85                            | 85                                     | 85                            | 85                            |                       | 42                      | 53                            | 85                                     | 53                            | 85                            |                       | 42                     | 33                            | 24                                     | 24                            | 24                            |
|                                                                                    | 48                     | 85                            | 85                                     | 85                            | 85                            |                       | 48                      | 49                            | 73                                     | 48                            | 73                            |                       | 48                     | 30                            | 22                                     | 22                            | 22                            |
|                                                                                    | 54                     | 85                            | 85                                     | 85                            | 85                            |                       | 54                      | 47                            | 62                                     | 45                            | 62                            |                       | 54                     | 28                            | 25                                     | 25                            | 25                            |
|                                                                                    | 60                     | 85                            | 85                                     | 85                            | 85                            |                       | 60                      | 45                            | 53                                     | 43                            | 53                            |                       | 60                     | 26                            | 22                                     | 22                            | 22                            |
|                                                                                    | 66                     | 85                            | 85                                     | 85                            | 85                            |                       | 66                      | 44                            | 46                                     | 41                            | 46                            |                       | 66                     | 25                            | 19                                     | 19                            | 19                            |
| 48                                                                                 | 24                     | 85                            | 85                                     | 85                            | 85                            | 78                    | 24                      | 72                            | 85                                     | 49                            | 85                            | 108                   | 24                     | 49                            | 32                                     | 28                            | 32                            |
|                                                                                    | 30                     | 85                            | 85                                     | 85                            | 85                            |                       | 30                      | 60                            | 75                                     | 46                            | 75                            |                       | 30                     | 41                            | 26                                     | 26                            | 26                            |
|                                                                                    | 36                     | 85                            | 85                                     | 85                            | 85                            |                       | 36                      | 53                            | 66                                     | 44                            | 66                            |                       | 36                     | 35                            | 23                                     | 23                            | 23                            |
|                                                                                    | 42                     | 85                            | 85                                     | 85                            | 85                            |                       | 42                      | 47                            | 72                                     | 47                            | 72                            |                       | 42                     | 31                            | 20                                     | 20                            | 20                            |
|                                                                                    | 48                     | 85                            | 85                                     | 85                            | 85                            |                       | 48                      | 44                            | 59                                     | 43                            | 59                            |                       | 48                     | 28                            | 18                                     | 18                            | 18                            |
|                                                                                    | 54                     | 85                            | 85                                     | 83                            | 85                            |                       | 54                      | 41                            | 50                                     | 40                            | 50                            |                       | 54                     | 26                            | 17                                     | 17                            | 17                            |
|                                                                                    | 60                     | 85                            | 85                                     | 81                            | 85                            |                       | 60                      | 39                            | 43                                     | 38                            | 43                            |                       | 60                     | 24                            | 19                                     | 19                            | 19                            |
|                                                                                    | 66                     | 85                            | 85                                     | 79                            | 85                            |                       | 66                      | 38                            | 38                                     | 36                            | 38                            |                       | 66                     | 23                            | 16                                     | 16                            | 16                            |
| 54                                                                                 | 24                     | 85                            | 85                                     | 85                            | 85                            | 84                    | 24                      | 66                            | 71                                     | 43                            | 71                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 30                     | 85                            | 85                                     | 85                            | 85                            |                       | 30                      | 55                            | 59                                     | 41                            | 59                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 36                     | 85                            | 85                                     | 85                            | 85                            |                       | 36                      | 48                            | 51                                     | 38                            | 51                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 42                     | 82                            | 85                                     | 79                            | 85                            |                       | 42                      | 43                            | 46                                     | 43                            | 46                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 48                     | 79                            | 85                                     | 73                            | 85                            |                       | 48                      | 39                            | 49                                     | 39                            | 49                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 54                     | 78                            | 85                                     | 69                            | 85                            |                       | 54                      | 37                            | 41                                     | 36                            | 41                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 60                     | 78                            | 85                                     | 66                            | 85                            |                       | 60                      | 35                            | 36                                     | 34                            | 36                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 66                     | 78                            | 85                                     | 64                            | 85                            |                       | 66                      | 34                            | 31                                     | 31                            | 31                            |                       |                        |                               |                                        |                               |                               |
| 60                                                                                 | 24                     | 85                            | 85                                     | 77                            | 85                            | 90                    | 24                      | 61                            | 57                                     | 38                            | 57                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 30                     | 84                            | 85                                     | 84                            | 85                            |                       | 30                      | 50                            | 47                                     | 36                            | 47                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 36                     | 75                            | 85                                     | 75                            | 85                            |                       | 36                      | 44                            | 41                                     | 34                            | 41                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 42                     | 69                            | 85                                     | 68                            | 85                            |                       | 42                      | 39                            | 37                                     | 33                            | 37                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 48                     | 66                            | 85                                     | 63                            | 85                            |                       | 48                      | 36                            | 41                                     | 36                            | 41                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 54                     | 64                            | 85                                     | 59                            | 85                            |                       | 54                      | 33                            | 35                                     | 33                            | 35                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 60                     | 63                            | 84                                     | 56                            | 84                            |                       | 60                      | 32                            | 30                                     | 30                            | 30                            |                       |                        |                               |                                        |                               |                               |
|                                                                                    | 66                     | 63                            | 73                                     | 54                            | 73                            |                       | 66                      | 30                            | 26                                     | 26                            | 26                            |                       |                        |                               |                                        |                               |                               |

\*Table 3 is to be used for the mullion that goes through the 4-way frame intersection, which is the structural thru-mull.  
Use Table 1 for the remaining, intermediate 2-way mullions.



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 12 of 15

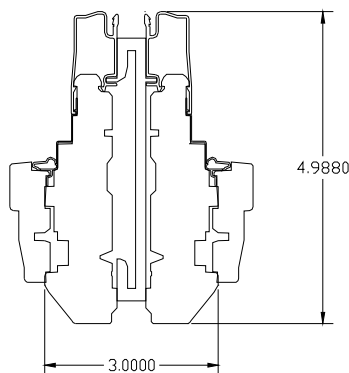
**Product Grouping:**

1. Reserve and Lifestyle Series Clad combination assemblies with structural mullion part No. 0A6G in intermixed configurations of casement, Awning, Picture, In-sash or Direct set Geometric or Radius.
2. Window type grouping: operable vs. fixed window load distribution was considered in the determination of the theoretical stress and deflection analysis due to mullion bending load and how concentrated loads produce higher bending stresses and deflections.

**Section Property Grouping:**

1. The casement type frame components combined with the structural mullion produce the lowest overall combined composite section properties. The aluminum clad, wood jamb and aluminum mullion act as one member.
2. The illustration below shows the individual component section properties for the casement window.
3. The intermixed combinations of Casement, Awning, Picture, In-Sash, and Direct Set geometric or Radius were examined, the combined section properties calculated using AutoCad (independent of material stiffnesses), and based on comparison of these section properties the combination of units that produce the weakest section determined. This section, combined with the mullion was used in the analysis.

**MULLIONS COMPOSITE SECTION PROPERTIES**



Casement with Structural Mullion used in analysis is shown at left. Only the aluminum clad, wood jamb and wood side stop combined with the structural mullion is used in the calculation of section properties. The wood and aluminum mull covers are not considered.

The combined section properties for the above, considering the material differences were found to be the following.

|     |                        |                        |
|-----|------------------------|------------------------|
| I = | 3.2727 in <sup>4</sup> | (In terms of aluminum) |
| S = | 1.5384 in <sup>3</sup> |                        |
| A = | 2.5628 in <sup>2</sup> |                        |

The individual aluminum clad, wood jamb, wood side stop and structural mullion section properties used to determine the combined section properties are given on the following page.

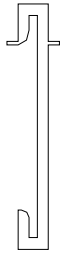


**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 13 of 15

**Structural Mull (VT or HZ)**



----- REGIONS -----  
Area: 1.0677  
Perimeter: 12.5983  
Bounding box: X: -0.5149 -- 0.3591  
Y: -2.1274 -- 2.0756  
Centroid: X: 0.0000  
Y: 0.0000  
Moments of inertia: X: 2.1261  
Y: 0.0246  
Product of inertia: XY: -0.0017  
Radii of gyration: X: 1.4111  
Y: 0.1518  
Principal moments and X-Y directions about centroid:  
I: 0.0246 along [0.0008 -1.0000]  
J: 2.1261 along [1.0000 0.0008]

**Aluminum Cladding (VT or HZ)**



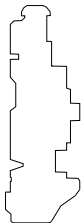
----- REGIONS -----  
Area: 0.1832  
Perimeter: 8.5210  
Bounding box: X: -0.3900 -- 0.4240  
Y: -1.0013 -- 0.6407  
Centroid: X: 0.0000  
Y: 0.0000  
Moments of inertia: X: 0.0403  
Y: 0.0182  
Product of inertia: XY: -0.0078  
Radii of gyration: X: 0.4692  
Y: 0.3152  
Principal moments and X-Y directions about centroid:  
I: 0.0157 along [0.3019 -0.9534]  
J: 0.0428 along [0.9534 0.3019]

**Wood Side Stop (VT or HZ)**



----- REGIONS -----  
Area: 0.9721  
Perimeter: 5.6195  
Bounding box: X: -0.3265 -- 0.3715  
Y: -1.0161 -- 0.9037  
Centroid: X: 0.0000  
Y: 0.0000  
Moments of inertia: X: 0.2751  
Y: 0.0293  
Product of inertia: XY: 0.0319  
Radii of gyration: X: 0.5320  
Y: 0.1735  
Principal moments and X-Y directions about centroid:  
I: 0.0252 along [0.1265 0.9920]  
J: 0.2792 along [-0.9920 0.1265]

**wood Jamb (VT or HZ)**



----- REGIONS -----  
Area: 3.3695  
Perimeter: 11.4918  
Bounding box: X: -0.5527 -- 0.6973  
Y: -1.8257 -- 2.1593  
Centroid: X: 0.0000  
Y: 0.0000  
Moments of inertia: X: 3.8249  
Y: 0.2682  
Product of inertia: XY: -0.0773  
Radii of gyration: X: 1.0654  
Y: 0.2821  
Principal moments and X-Y directions about centroid:  
I: 0.2665 along [0.0217 -0.9998]  
J: 3.8266 along [0.9998 0.0217]



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 14 of 15

**SECTION PROPERTY COMPARISON CHART (VT. & HZ.)**

| Brand                                  | Product                 | Section    | Exterior    | MOI_Wood      | MOI_Alum      | Stiffness Factor | MOE_Wood<br>(x10 <sup>6</sup> psi) | MOE_ALUM<br>(x10 <sup>6</sup> psi) |
|----------------------------------------|-------------------------|------------|-------------|---------------|---------------|------------------|------------------------------------|------------------------------------|
| Minimum of Compared Section Properties | Window Mullion Charts   | All        | Clad        | 4.1239        | 0.0403        | 5.76407          | 1.3                                | 10                                 |
| <b>Reserve and Lifestyle Series</b>    | Clad Frame (Direct Set) | All        | Clad        | 4.3409        | 0.0369        | 6.01217          |                                    |                                    |
| <b>Reserve Series</b>                  | Casement                | All        | Wood        | 5.8819        | 0             | 7.64647          |                                    |                                    |
|                                        | Model 4 DH              | Jamb       | Wood        | 10.9364       | 0             | 14.21732         |                                    |                                    |
|                                        | Model 4 DH              | Head       | Wood        | 6.9324        | 0             | 9.01212          |                                    |                                    |
|                                        | Model 3 DH              | Jamb       | Wood        | 7.7429        | 0             | 10.06577         |                                    |                                    |
|                                        | Model 3 DH              | Head       | Wood        | 5.1873        | 0             | 6.74349          |                                    |                                    |
|                                        | <b>Casement</b>         | <b>All</b> | <b>Clad</b> | <b>4.1239</b> | <b>0.0403</b> | <b>5.76407</b>   |                                    |                                    |
|                                        | Model 3 DH              | Jamb       | Clad        | 4.7736        | 0.0455        | 6.66068          |                                    |                                    |
|                                        | Model 3 DH              | Head       | Clad        | 4.6296        | 0.0221        | 6.23948          |                                    |                                    |
|                                        | Model 4 DH              | Jamb       | Clad        | 6.7893        | 0.0455        | 9.28109          |                                    |                                    |
|                                        | Model 4 DH              | Head       | Clad        | 5.1533        | 0.0221        | 6.92029          |                                    |                                    |
| <b>Lifestyle Series with HGP</b>       | <b>Casement</b>         | <b>All</b> | <b>Clad</b> | <b>4.1239</b> | <b>0.0403</b> | <b>5.76407</b>   |                                    |                                    |
| <b>Lifestyle Series w/o HGP</b>        | <b>Casement</b>         | <b>All</b> | <b>Clad</b> | <b>4.1239</b> | <b>0.0403</b> | <b>5.76407</b>   |                                    |                                    |
|                                        | Double Hung             | Jamb       | Clad        | 4.9908        | 0.0207        | 6.69504          |                                    |                                    |
|                                        | Double Hung             | Head       | Clad        | 4.9565        | 0.0188        | 6.63145          |                                    |                                    |

**Discussion:**

- 1). Frame Section Properties above provided by Pella Corporation.
- 2). Ixx is moment of Inertia about axis of bending of the mulled configuration , Ymax is the maximum distance from "X" axis to outer fibers of the section in the "y" direction. Zx is section modulus = Ixx / y max. A is area.
- 3). The configuration with the lowest I and Z will envelope all other configurations. A is relatively the same for all, except the DS radius, therefore will not be deciding factor.
- 4). Based on the above comparison of sections the casement jamb is the worst case.
- 5). Comparison above based on section properties of the combined sections without the reinforced mullion. Adding the reinforcement has the same affect on each combination. So the weakest combination without reinforcement will still be the weakest combination with reinforcement.



**PTC PRODUCT DESIGN GROUP, LLC**

P.O. Box 520775  
Longwood, Florida 32752

Client: Pella Corporation  
Project #: 423-1101  
Report #: 0503-1  
Prepared by: RJA  
Date: 2/4/2024  
Page 15 of 15

THE FOLLOWING CONFIGURATIONS ARE EXAMPLES IN THIS REPORT

